

Chapter 14: The Earth's resources 1

Knowledge organiser

Natural and synthetic resources

We use the Earth's resources to provide us with warmth, fuel, shelter, food, and transport.

- Natural resources are used for food, timber, clothing, and fuels.
- Synthetic resources are made by scientists. They can replace or supplement natural resources.

When choosing and synthesising resources, it is important to consider **sustainable development**. This is development that meets the needs of current generations without compromising the ability of future generations to meet their own needs.

Potable water

Water is a vital resource for life. **Potable** water is water that is safe to drink. However, most water on Earth is not potable.

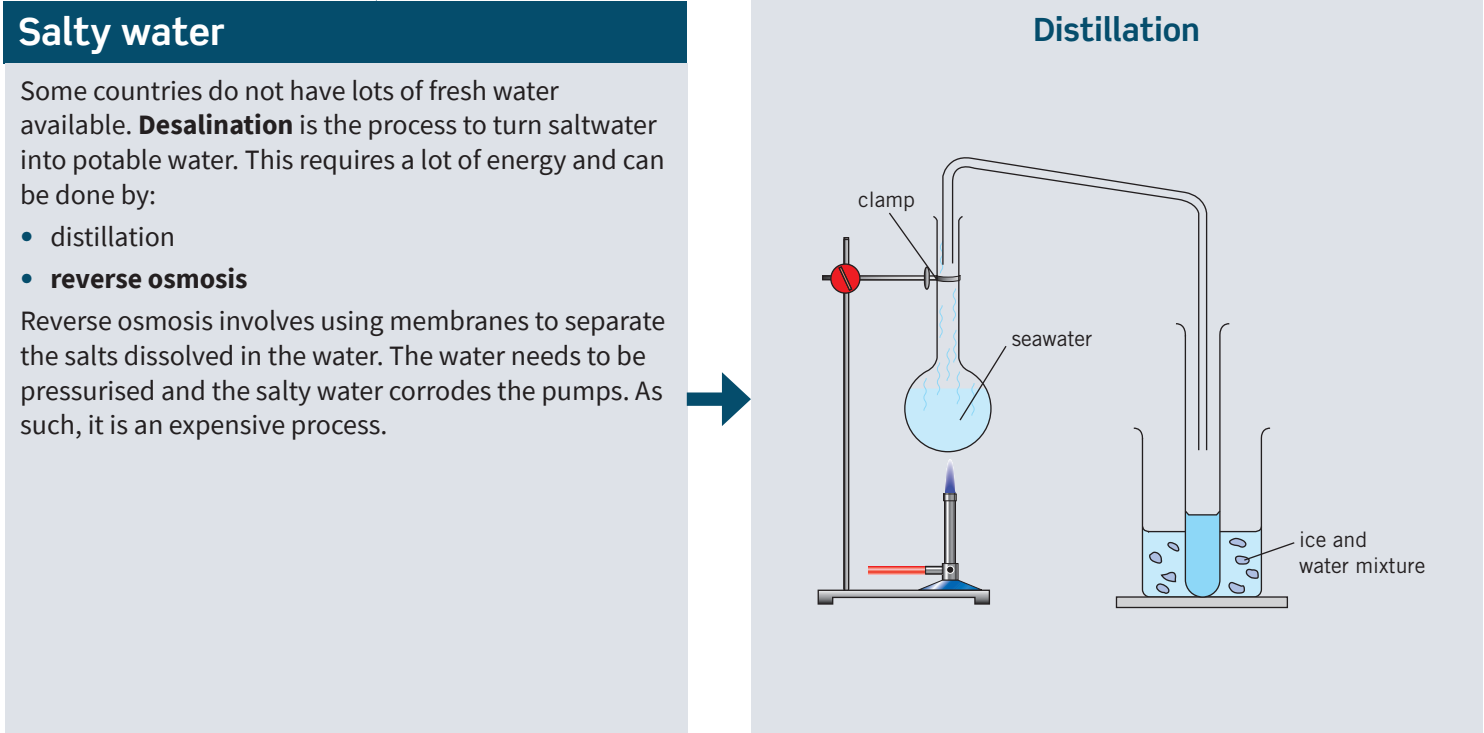
Type of water	What it has in it
pure water	just water molecules and nothing else
potable water	water molecules, low levels of salts, safe levels of harmful microbes
salty water (sea water)	water molecules, dangerously high levels of salt, can have high levels of harmful microbes
fresh water (from rivers, lakes, or underground)	water molecules, low levels of salt, often has harmful microbes at high levels

Salty water

Some countries do not have lots of fresh water available. **Desalination** is the process to turn saltwater into potable water. This requires a lot of energy and can be done by:

- distillation
- reverse osmosis

Reverse osmosis involves using membranes to separate the salts dissolved in the water. The water needs to be pressurised and the salty water corrodes the pumps. As such, it is an expensive process.



Fresh water

In the UK, potable water is produced from rain water that collects in lakes and rivers. To produce potable water:

- 1 Choose an appropriate source of fresh water.
- 2 Pass the water through filters to remove large objects.
- 3 **Sterilise** the water to kill any microbes using ozone, chlorine, or UV light.

Finite and renewable resources

Some resources are **finite**. This means that they will eventually run out.

Fossil fuels are an example of a finite resource. They take so long to form that we use them faster than they are naturally formed.

Resources that will not run out are called **renewable** resources.

Wood is an example of a renewable resource. Trees can be grown to replace any that are cut down for wood.

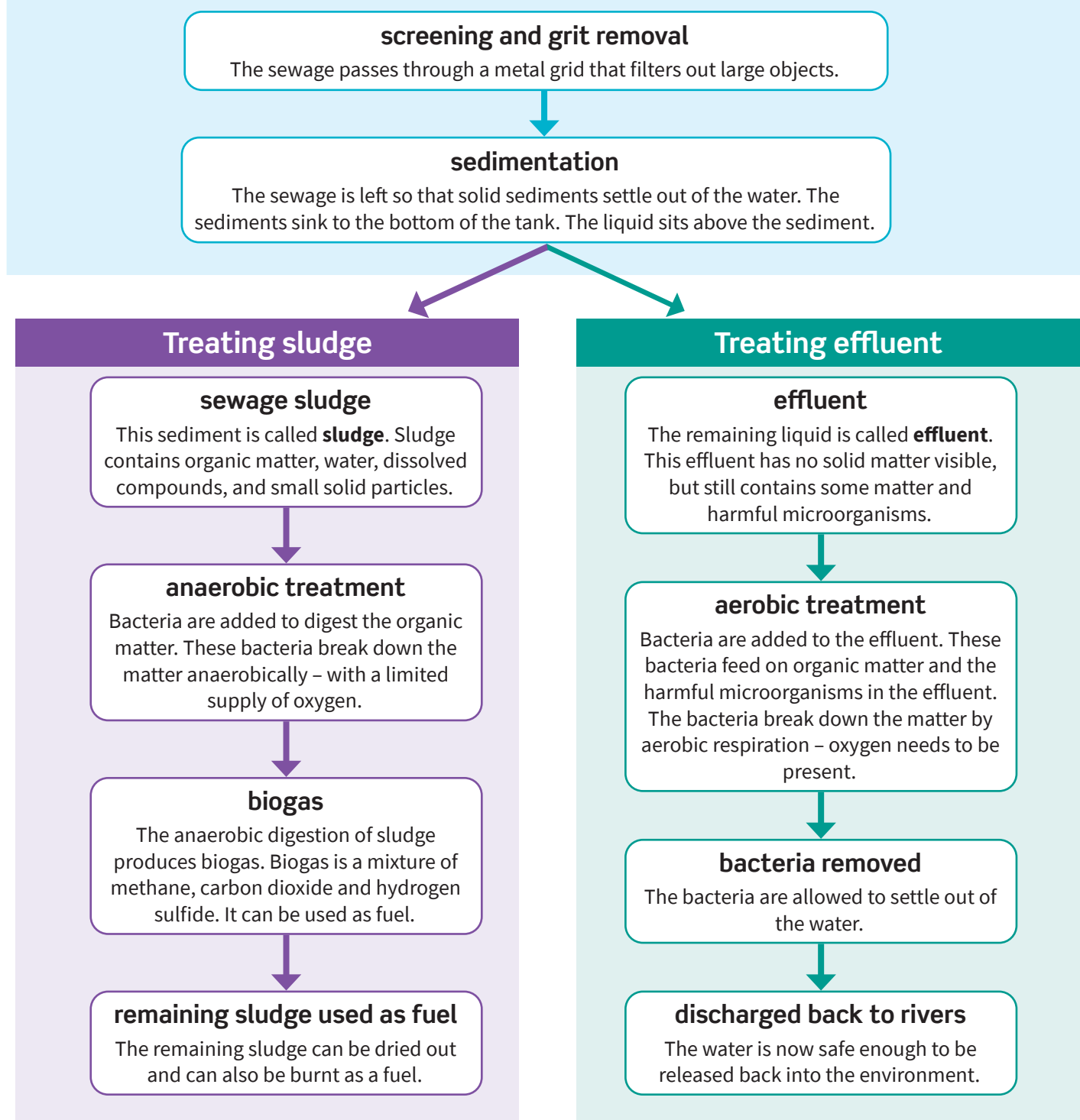
Waste water

Human activities produce lots of waste water as sewage, agricultural waste, and industrial waste.

- **Sewage** and agricultural waste contain organic matter and harmful microbes.
- Industrial waste contains organic matter and harmful chemicals.

These need to be removed before the water can be put back into the environment.

Treating sewage water



Chapter 14: The Earth's resources 2

Knowledge organiser

Metal extraction (HT only)

Metals are used for many different things. Some metals can be extracted from their ores by reduction or electrolysis. However, metal ores are a finite resource and these processes require lots of energy. Scientists are looking for new ways to extract metals that are more sustainable.

Phytomining and **bioleaching** are two alternative processes used to extract copper from low grade ores (ores with only a little copper in them).

Phytomining

- 1 Grow plants near the metal ore.
- 2 Harvest and burn the plants.
- 3 The ash contains the metal compound.
- 4 Process the ash by electrolysis or displacement with scrap metal.

Bioleaching

- 1 Grow bacteria near the metal ore.
- 2 Bacteria produce leachate solutions that contain metal compound.
- 3 Process the leachate by electrolysis or displacement with scrap metal.

Both of these methods avoid the digging, moving, and disposing of large amounts of rock associated with traditional mining techniques.

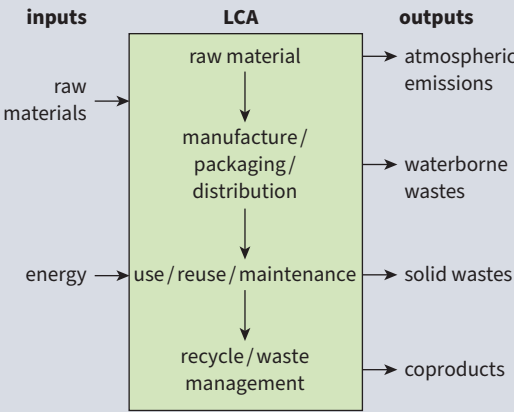
Life cycle assessment

A **life cycle assessment (LCA)** is a way of looking at the whole life of a product and assessing its impact on the environment and sustainability. It is broken down into four categories:

- extracting and processing raw materials
- manufacturing and packaging
- use and operation during its lifetime
- disposal at the end of its useful life, including transport and distribution at each stage

Some parts of an LCA are objective, such as the amount of water used or waste produced in the production of a product.

However, other parts of an LCA require judgements, such as the polluting effect, and so LCAs are not a completely objective process.



Disposal of products

When someone finishes with a product, it can be

- added to a landfill
This can cause habitat loss and other problems in the local ecosystem. Some items persist in landfills as they do not **biodegrade** and could be there for hundreds of years.
- incinerated
Some products can be incinerated to produce useful energy. However, the combustion can often be incomplete and result in harmful pollutants being released to the atmosphere.
- reused
This is when an item is used again for a similar purpose.
- **recycled**
Recycling requires energy, but conserves the limited resources and often requires less energy than needed to make brand new materials.

The table shows information about the extraction, processing, and disposal of some common materials. This information is used when making a LCA.

Material	Extraction/processing	Disposal
metal	<ul style="list-style-type: none">• quarrying and mining cause habitat loss• machinery involved in mining release greenhouse gases• extraction from metal ores require lots of energy	<ul style="list-style-type: none">• metals can normally be recycled by melting them down and then casting them into new shapes• metals in landfill can persist for a long time
plastic	normally come from fossil fuels that are non-renewable	<ul style="list-style-type: none">• many plastic products can be reused and recycled• plastics often end up in landfills where they persist as they are not biodegradable• incinerating plastics releases lots of harmful pollutants like carbon monoxide and particulates
paper	produced from trees that require land and lots of water to grow lots of water also used in the production process	<ul style="list-style-type: none">• many paper products can be recycled• paper products can also be incinerated or they can decay naturally in a landfill• incineration and decay release greenhouse gases
glass	produced by heating sand, which requires a lot of energy	<ul style="list-style-type: none">• many glass products can be reused, or crushed and recycled• if glass is added to landfills it persists as it is not biodegradable
ceramics	<ul style="list-style-type: none">• come from clay and rocks• generally require quarrying, which requires energy, releases pollutants from heavy machinery, and causes habitat loss	<ul style="list-style-type: none">• most ceramics are not commonly recycled in the UK, and once broken cannot be reused• ceramics tend to persist in landfills



Key terms

Make sure you can write a definition for these key terms.

aerobic anaerobic biodegrade bioleaching distillation effluent
finite resources life cycle assessment phytomining potable water recycling
renewable resources reverse osmosis screening sedimentation sewage
sludge sterilisation sustainable development